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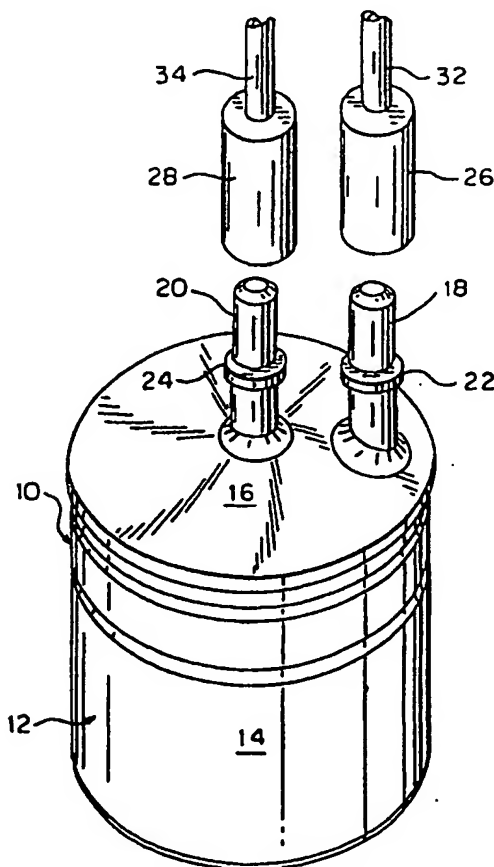
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[Continued on next page]

(54) Title: FLUID FILTER CARTRIDGE ARRANGEMENT AND ADAPTER



(57) Abstract: A spin-on-type oil filter cartridge (21) is converted to a quick connect cartridge (14) suitable as a lifetime filter for an automotive vehicle by spinning an adapter (16) onto the spin-on cartridge. The adapter (16) has a pair of quick connect coupling elements (26 and 28), one of which is aligned with an external threaded lug (64) that is coupled to a threaded central opening (46) in the spin-on cartridge (12) and the other of which communicates with a chamber (56) that is in turn in communication with a plurality of radially disposed, spaced apart openings (40) through the end plate of the spin-on filter cartridge (12). A fuel resistant adhesive (84 and 86) which also serves as a seal, bonds the adapter (16) to a crimped end of the spin-on cartridge (12) and bonds the externally threaded lug (64) to the internally threaded opening in the spin-on cartridge (48). A filter media (36) suitable for filtering fuel is placed within the spin-on cartridge.



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## **FLUID FILTER CARTRIDGE ARRANGEMENT AND ADAPTER**

### **Field of the Invention**

The present invention is directed to a fluid filter cartridge and adapter. More particularly, the present invention is directed to an arrangement and adapter for  
5 converting a spin-on filter cartridge to a quick connect filter cartridge.

### **Background of the Invention**

Fuel filters generally have a much longer life than oil filters because fuel tends to be very clean and substantially free from particulate matter when it is dispensed  
10 from commercial fuel pumps. Moreover, a fuel filter does not filter a re-circulating liquid into which particulate matter resulting from combustion as well as being introduced via combustion air streams must be removed. Fuel filters therefore have tended to be relatively small but their small size means that they need to be changed during the lifetime of the vehicle. By substantially increasing the size of fuel filters, it  
15 becomes possible for them to last the lifetime of a vehicle since it is highly unlikely that a relatively large fuel filter will become clogged during the life of a vehicle.

Spin-on oil filters generally have a size which will accommodate a quantity of filter media, which, in a fuel filter, would be sufficient to last the lifetime of a vehicle

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and the technology for manufacturing spin-on filters in immense numbers has now been developed sufficiently so that spin-on oil filters are relatively inexpensive. Spin-on oil filters are, however, not suitable for use as fuel filters because spin-on oil filters have a particular coupling arrangement in which there is a center fluid outlet (or inlet as the case may be) and a plurality of radially disposed, spaced apart fluid inlets (or outlets if the flow is reversed). The fuel system of an engine does not have a facility to receive such a filter so that spin-on oil filters are not available for use as fuel filters.

#### Summary of the Invention

According to the present invention there is provided a filter unit comprising a spin-on filter cartridge having a periphery, a plurality of spaced apart openings radially disposed with respect to an axis of the spin-on filter cartridge and a central opening aligned with that axis, wherein the central opening has spin-on coupling means, the filter unit further comprising a cap seated on the spin-on filter cartridge; a first element of a quick connect coupling extending from the cap and being in communication with the plurality of spaced apart openings of the spin-on filter cartridge; and a second element of the quick connect coupling extending from the cap and being coupled to the central opening of the spin-on filter cartridge. The present

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invention thus makes it possible to adapt the technology developed for spin-on oil filters to other arrangements such as filters which have quick connect couplings for other uses.

The present invention also provides an adapter for use with a spin-on filter cartridge to provide a filter unit as defined above. The first and second ports of the adapter may be configured to couple with external lines by using quick connect couplings. For a preferred use, the spin-on filter cartridge is preferably permanently secured to the adapter, for example by means of an adhesive.

#### **Brief Description of the Drawings**

Various other features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts through the several views, and wherein:

Figure 1 is a perspective view of a filter unit configured in accordance with the principles of the present invention;

Figure 2 is a side view of the filter unit of Figure 1;

Figure 3 is a top view of the filter unit of Figures 1 and 2;

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Figure 4 is a side elevation of a spin-on filter cartridge which forms a portion of the filter unit of Figures 1-3;

Figure 5 is an end view of the filter cartridge of Figure 4;

Figure 6 is a side view of an adapter used with the spin-on filter cartridge of

5 Figures 4 and 5 to form the filter unit of Figures 1-3;

Figure 7 is an end view of the adapter of Figure 6; and

Figure 8 is a side elevation of the adapter of Figures 6 and 7.

### Detailed Description

10 Referring now to Figures 1-3, there is shown a filter unit configured in accordance with the principles of the present invention wherein a spin-on filter cartridge 12 is converted to a quick connect filter cartridge 14 by an adapter 16 that has extending therefrom a first tube 18 and a second tube 20. The tubes 18 and 20 have annular ribs 22 and 24, respectively, which receive quick connect couplings 26 and 28 which may be of a known configuration. By using the adapter 16, the spin-on  
15 filter 12 is adapted for a quick connect coupling rather than a spin-on coupling with another device. In a specific aspect of the invention, the other device is a fuel system of an internal combustion engine which has a first line 32 connected to the quick

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connect coupling 26 and a second line 34 connected to the quick connect coupling 28.

In accordance with the preferred embodiment, fuel flows through the line 32 into the tube 18 and from the tube 20 out through the line 34. The tube 18 with the annular rib 22 forms a first element of a quick connect coupling for coupling with the quick connect coupling element 26 while the tube 20 and annular rib 24 form a second element of a quick connect coupling for coupling with the quick connect coupling element 28. The quick connect filter cartridge 14 is intended to last for the life of the internal combustion engine to which it is fitted.

By using the spin-on filter cartridge 12, with filter media of a composition useful in filtering fuel, the technology of spin-on oil filters becomes available for the fabrication of fuel filters so that the cost of fuel filters is substantially reduced. Referring now to Figures 4 and 5, the spin-on filter cartridge 12 has filter media 36 of a material suitable for filtering fuel rather than filtering oil. The spin-on filter has also had its conventional gasket shown in dotted lines 38 removed. As with an oil filter, fuel enters a plurality of radially disposed, spaced apart openings 40 in an end plate 42, passes through the filter media 36 into a hollow core 44 of the filter media, and then flows out of a central opening 46. While the fuel is shown flowing into the central openings 40 and out of the central opening 46, these types of filters also

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function with an opposite flow wherein fluid flows into the opening 46, passes through the filter element 36 and then out of the openings 40. In order for the cartridge 12 to be a spin-on cartridge, the central opening 46 has a helical thread 48 disposed about the axis 49 of the spin-on cartridge 12.

5 Referring now to Figures 6-8, it is seen that the adapter 12 comprises a cap 50 having a convex outer surface 52 and a concave inner surface 54. The concave inner surface 54 partially defines a chamber 56 on the inside of the cap 50, which chamber communicates with a first port 58, the first port being in communication with the first tube 18 that provides a first element of a quick connect coupling when it couples with a quick connect coupling element 26. The cap also includes a second port 60 which is 10 aligned with an axis 62 that coincides with the axis 49 of the spin-on filter cartridge 12. Projecting through the chamber portion 56 is an externally threaded lug 64 which has threads 66 that mate with the helical thread 48 of the internally threaded opening 46 in the spin-on filter cartridge 12 (see Figure 4).

15 The cap 50 has a depending peripheral flange 70 which projects from the concave inner surface 54 thereof slightly inboard of a peripheral edge 72 of the cap. A lip 74 is therefore defined adjacent the flange 70 of the cap so as to form a shoulder 76 adjacent the peripheral annular flange 70. The flange 70 has an outside dimension



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which fits inside an annular crimped edge 80 of the spin-on filter cartridge 12 as is seen in Figures 4 and 5. The shoulder 76 defined by the lip abuts the crimped edge 80 as is seen in Figure 4 when the adapter 16 is seated on the spin-on filter cartridge 12.

In order to render this connection permanent, a layer of adhesive 84 is disposed  
5 between the area defined by the flange 70 and lip 72 and the area defined by the crimped end 80 of the spin-on filter cartridge 12. The layer of adhesive 84 is comprised of an adhesive that is fuel resistant so that it will maintain its bond and form a leak-proof seal over the life of the quick connect fuel cartridge 14 formed by the union of the adapter 16 and spin-on filter cartridge 12.

10 A layer of adhesive 86 with sealing properties is also placed between the threads 66 of the externally threaded lug 64 on the cap 50 and the internal threads 48 in the opening 46 of the spin-on filter cartridge 12. Accordingly, while the adhesives 86 and 84 have not yet hardened the adapter 16 can be spun on to the spin-on filter cartridge 12 until the adapter and spin-on filter cartridge are tightly engaged with one  
15 another. After the adhesive 84 and 86 cure, the adapter 16 is permanently fixed to the spin-on filter cartridge 12 and the resulting quick connect fuel cartridge 14 is provided to serve as a lifetime fuel filter for vehicles.

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Although one form of quick connect coupling has been shown in Figure 1, it will be appreciated that the principles underlying the present invention may be applied to other forms of quick connect coupling.

**CLAIMS:**

1. A filter unit comprising a spin-on filter cartridge having a periphery, a plurality of spaced apart openings radially disposed with respect to an axis of the spin-on filter cartridge and a central opening aligned with that axis, wherein the central opening has spin-on coupling means, the filter unit further comprising:

a cap seated on the spin-on filter cartridge;

a first element of a quick connect coupling extending from the cap and being in communication with the plurality of spaced apart openings of the spin-on filter cartridge; and

a second element of the quick connect coupling extending from the cap and being coupled to the central opening of the spin-on filter cartridge.

2. A filter unit as claimed in claim 1, wherein the spin-on filter cartridge includes filter media configured to filter fuel, whereby the resulting quick-connect filter cartridge functions as a fuel filter.

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3. A filter unit as claimed in claim 1 or 2, wherein the cap has a concave inner surface which forms a chamber, wherein the chamber communicates with the first element of the quick connect coupling and wherein the second element of the quick connect coupling is isolated from the chamber.

4. A filter unit as claimed in claim 3, wherein the chamber communicates with the plurality of radially disposed, spaced apart openings in the spin-on filter cartridge.

5. A filter unit as claimed in any preceding claim wherein the spin-on coupling means comprises a screw thread provided within the central opening of the spin-on filter cartridge, and wherein the second element includes an annular threaded lug which makes a threaded connection with the central opening of the spin-on filter cartridge.

6. A filter unit as claimed in any preceding claim, wherein a sealing adhesive is provided on the threaded lug for providing a fluid tight seal between the threaded projection and the threads of the central opening.

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7. A filter unit as claimed in any preceding claim further including a first fluid tight seal disposed between the periphery of the spin-on filter cartridge and the cap.
8. A filter unit as claimed in claim 6 or 7, wherein a second fluid tight seal is disposed between the annular threaded projection and the central opening of the spin-on filter cartridge.
9. A filter unit as claimed in any preceding claim, wherein the cap is permanently secured to the spin-on filter cartridge.
10. A filter unit as claimed in any preceding claim, wherein the cap is permanently secured to the spin-on filter cartridge, by means of an adhesive.
11. A filter unit as claimed in any preceding claim, wherein the cap has a concave inner surface and a convex outer surface.

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12. A filter unit as claimed in any preceding claim, wherein the cap has an axis aligned with the axis of the spin-on filter cartridge.

13. A filter unit as claimed in any preceding claim, wherein the first element comprises a first port disposed radially with respect to the axis of the filter cartridge and the second element comprises a second port aligned with the axis of the filter cartridge.

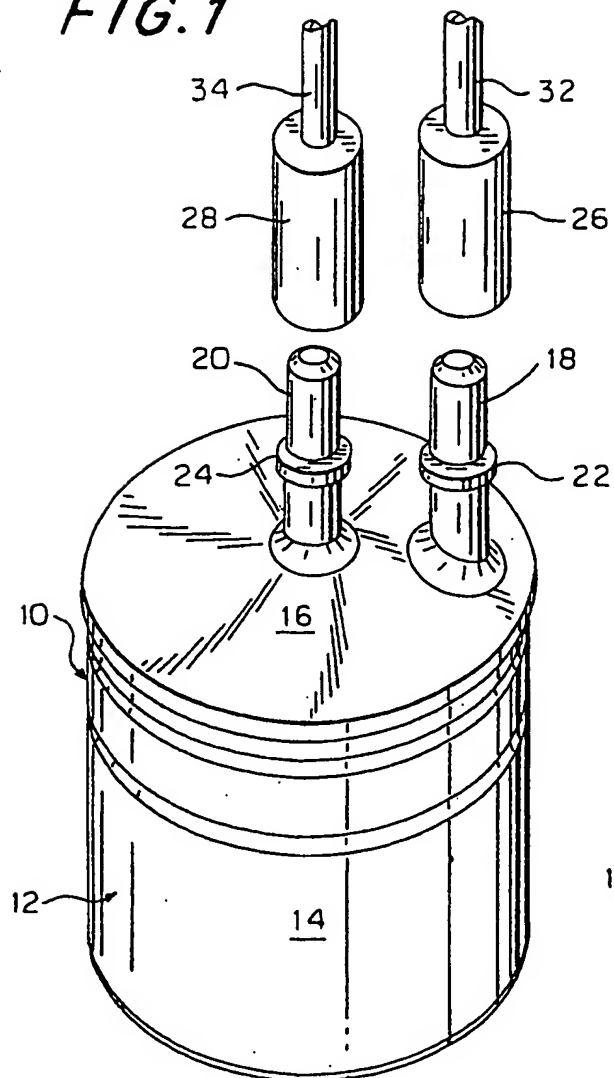
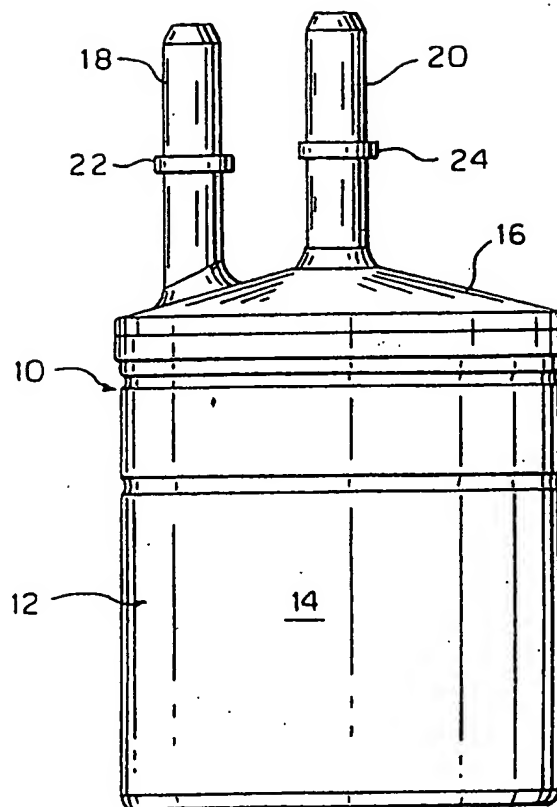
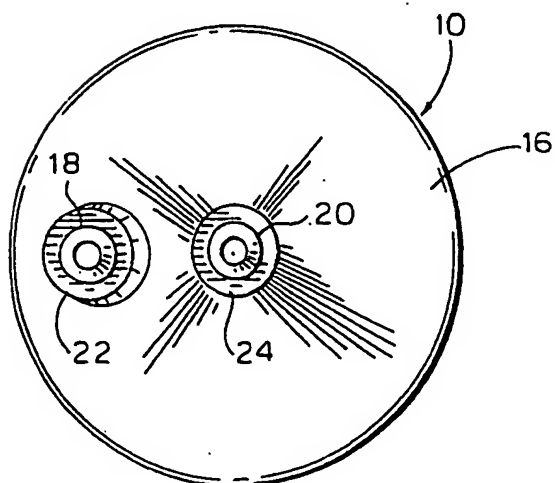
14. A filter unit as claimed in claim 13, wherein the first element comprises a first tube extending from the first port of the quick connect coupling and the second element comprises a second tube extending from the second port of the quick connect coupling, the first and second tubes being adapted for quick connect coupling with fluid lines for transmitting fluid to and from the cap.

15. A filter unit as claimed in any preceding claim, wherein the first port is an inlet port and the second port is an outlet port.

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16. A filter unit substantially as described herein with reference to, and as shown in, Figures 1 to 3 and 6 to 8 of the accompanying drawings.
17. An adapter comprising a cap for attachment to a spin-on filter cartridge to provide a filter unit in accordance with any one of the preceding claims.
18. An adapter substantially as described herein with reference to, and as shown in, Figures 6 to 8 of the accompanying drawings.

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**FIG. 1****FIG. 2****FIG. 3**



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FIG. 4

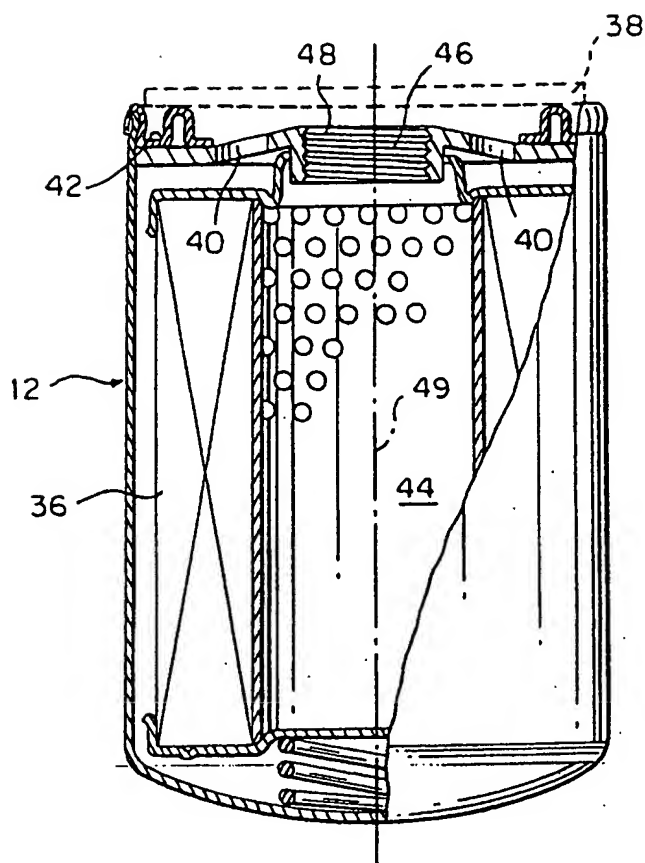
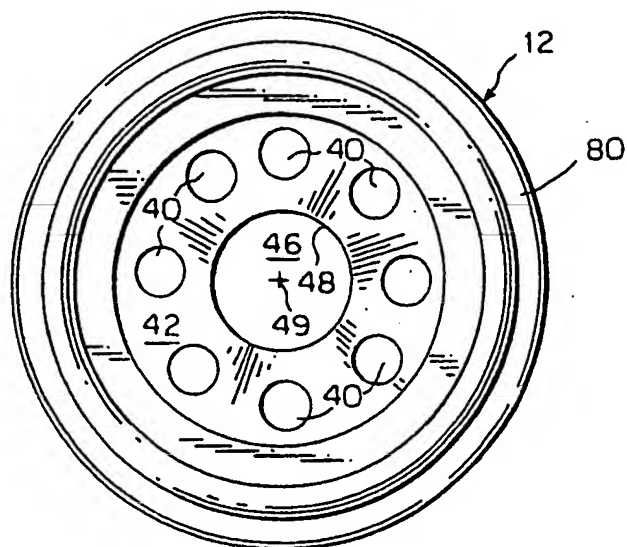


FIG. 5





## INTERNATIONAL SEARCH REPORT

Internat al Application No

PCT/GB 00/04318

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B01D27/08 B01D35/30 F02M37/22

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B01D F02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 44 44 934 A (KNECHT FILTERWERKE GMBH) 27 June 1996 (1996-06-27) the whole document	1-4, 7, 8, 11-18
X	GB 2 195 914 A (LUCAS IND PLC) 20 April 1988 (1988-04-20) the whole document	1, 2, 5, 7, 8, 12-18
A	WO 99 29392 A (BOSCH GMBH ROBERT) 17 June 1999 (1999-06-17) page 4, line 20 -page 5, line 16; figure 1	1, 2, 9, 12-18
A	DE 197 53 611 A (BOSCH GMBH ROBERT) 10 June 1999 (1999-06-10) figures 1, 2	1, 2, 9, 12-18

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Patent family members are listed in annex.

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Information on patent family members

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